A Right to Soweto:

Contextualizing the Modern Fire Station to Cultivate Community Hope and Agency in Soweto, South Africa

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Soweto, South Africa is known to be the largest Black urban settlement in Africa, with approximately 1.3 million people and between 46-76% of its people living in abject poverty[1]. A deeply rooted history of political uprisings has shaped the township into a socio-economically divided landscape of luxury homes, tourist attractions, and sprawling squatter settlements. Due to Soweto's political history, community members of the informal settlements have been known to have a general distrust of government institutions and have demonstrated resistance to the help of fire fighters in the past, despite the high risk of fires within the settlements. In response to this rich sociocultural and political challenge, I have developed a proposal for an Orlando West Fire Station that transcends institutional norms and dedicates its land and resources to serving the needs of the surrounding community. Because a large majority of the area's population lives below the poverty line and in informal settlements, the goal of this station is to give underserved Soweto citizens a full-fledged "Right to the City."

In a report by the South African Department of Environmental Affairs, *Long Term Adaptation Scenarios for Human Settlements*, the Right to the City is described as a key concept in developing environmentally just and sustainable urban spaces in South Africa. This movement to build inclusive cities advocates for the design and construction of institutions that integrate vulnerable communities and promote pro-poor adaptive development. The core principles of this movement are (1) to provide *full citizenship* for the people by ensuring collective wellbeing within urban habitats; (2) to encourage *democratic management* of the city by directly involving local people, governments, and organizations; and (3) to demonstrate an overarching *social*

[1] Harrison, Philip, and Kirsten Harrison. "Soweto: A Study in Socio-spatial Differentiation." In *Changing Space, Changing City: Johannesburg after Apartheid - Open Access Selection*, edited by HARRISON PHILIP, GOTZ GRAEME, TODES ALISON, and WRAY CHRIS, 293-318. Johannesburg: Wits University Press, 2014. Accessed May 9, 2021. doi:10.18772/22014107656.19.

function to serve the common good through strategies of social justice and environmental sustainability[2]. Giving underserved members of the Orlando West community a right to self-autonomy and urban resources became the focus of my project, integrated into the following building goals: service, security, sustainability, and symbolism.

I. Service through Programming

Due to the perceived division between citizens and the once militarized fire department, it is critical for the fire station to actively provide resources and/or services to the surrounding community as a form of reparation and reconciliation. To fulfill this goal, a significant portion of the built design and planned spaces will be dedicated solely to community functions and Soweto resident support spaces. By providing physical space for these functions, the government will demonstrate a literal and metaphorical commitment to the community through proper investment of funds, resources, and urban space. Aligning with food insecurity initiatives in Johannesburg and surrounding areas, the west side of the building site will be utilized as expansive community garden space. The site, much larger than the required Fire Station program, has a large expanse of undesignated, sloped land area, which would be efficiently utilized as naturally irrigated and terraced community gardens. While gardens require sufficient maintenance, the station will be able to integrate local urban agriculture organizations in Johannesburg that hold educational workshops and support community ownership[3]. With proper investment, the community garden

[2] Republic of South Africa DEA (Department of Environmental Affairs). n.d. *Climate Change Adaptation Perspective on Urban, Rural and Coastal Human Settlements in South Africa (ed. S.M. Munzhedzi, V.P. Khavhagali, G.M. Midgeley, P. de Abreu, S. Scorgie, M. Braun, Z. Abdul, M. Gaylard, J. Jesse Harber, O. Crispian Oliver, R. Schulze, G. Pegram, J. Cullis)*. Pretoria: Long-Term Adaptation Scenarios Flagship Research Programme.

[3] Tinashe Paul Kanosvamhira, "The organisation of urban agriculture in Cape Town, South Africa: A social capital perspective." *Development Southern Africa* 36, no. 3 (2018): 283-294. DOI: 10.1080/0376835X.2018.1456910

and support spaces can have far-reaching implications that empower all people, provide critical business opportunity, and improve the local market economy[4].

Through analysis of the site, it became clear that the eastern street corner is a critical point for signage and visibility– however, the western side of the site has the highest potential for workable garden space, as well as visibility and accessibility from the train station. Paved areas along the western façade of the building will create a critical pedestrian corridor, connecting the north and south pathways to the lobby entrances. Additionally, a multipurpose space for occasional marketplaces will be located along the western exterior, inviting garden users and businesses to congregate. To supplement the western exterior development, the building itself will invite the community inside the heart of the building with a welcoming lobby and multipurpose area for public meetings and events. Walls and panels in this area can be used as interior art gallery space for local students and artists. An additional interior community room will also be proposed in the southwest corner of the building to serve as supplementary garden storage and service space. The Demonstration Space, a required room in the program - intended to hold public demonstrations of fire safety and fire fighter roles – is designed as a flexible space, one that is equipped for fire demonstrations, as well as public events, such as lectures, socials, and interior markets. Through intentional programming, the fire station will seek to reach out and integrate locals. Regardless of socioeconomic status or skill, community members will be able to become active managers of their own garden plots and utilize multipurpose areas during working hours to sell produce and other items. Brick walls and interior surfaces will make way for public

[4] C M Rogerson, "Urban Agriculture in South Africa: Scope, Issues and Potential," *GeoJournal* 30, no. 1 (May 1993): pp. 21-28.

artwork displays and gallery space, and interior meeting rooms and the demonstration bay will be open for both public fire station events, as well as community-led activities and gatherings.

II. Security for all users

As a public building with both public and private purposes, the fire station design needs to secure the safety of the fire fighters, staff, and visitors. Due to potential for crime or violence and chemical pollution from apparatus bay support spaces, the program is organized so that public areas have a distinct separation from the private living and bay support spaces. Simultaneously adapting to gradual elevation changes on site, the building has a programmatic distinction through height, raising the private spaces up by three feet, leaving the public spaces to be accessible only on a lower level. In this way, access from the front lobby (public) to station living areas (private) can be controlled to a single point of vertical circulation, a ramp. The level change creates a physical separation between fire fighter spaces and community spaces; however, interior safety glass will be incorporated, allowing for open visual connection between the administrative rooms and community multipurpose areas.

Because exit doors are required from the living spaces for fire exits and program requirements, the north façade of the building utilizes exterior exit spaces in order to create additional privacy from the living quarters to the exterior parking. A neighborhood of informal settlements exists to the north of the site, so concealing the doorways will improve fire fighter security and create a more appealing northern façade.

As stated previously, the gardens and community programming will be used as a means to food and economical security for members of the community. Additionally, roofs and drainage are designed to harvest rainwater for landscaping, gardens, and water tanks for putting

out fires. An early proposal during our schematic design team discussions was to utilize excess rainwater collection to fill tanks that can be placed within centralized locations of the informal settlements. The density of settlements limits access by fire trucks to settlement fires, so having readily accessible water sources will allow residents and neighbors to help slow the spread of fires until the fire fighters are able to make it to the affected site.

III. Sustainability

A responsible design must consider its local and environmental impact. At the ending stages of Schematic Design, the building was wholly timber framed – utilizing locally-sourced timber from a company called GS Timbers, located in the same municipality of Johannesburg. Opting for local timber framing and recycled materials over primarily concrete and steel demonstrates our commitment to lowering the embodied carbon footprint of the building, as well as a resourcefulness inspired by the surrounding community. Moving forward into Design Development, it was realized that timber framing was not ideal for the tallest portions of the building, in terms of construction and cost. As a compromise, I decided that the large Apparatus Bay and Demonstration Bay, both ranging from 24-36 feet in height, will be steel-framed structures with open-web steel joist, and the remaining portion of the building (living and administration spaces) will be timber framed, using timber beams and timber trussing, as well as *sandbag* wall construction. Sandbag building technology uses a form of construction utilizing bags dry-packed with sand and/or rubble sourced on-site, plastered with clay and lime[5]. There are several precedents in Africa, primary residential, and this construction has proven to be durable, cost-efficient, environmentally responsible, and able to utilize unskilled labor.

[5] Horn, A., 2021. *Sandbag Building Technology*. [online] Eco Design Architects & Consultants. <https://www.ecodesignarchitects.co.za/naturalbuilding/11sandbag.html> [Accessed 10 March 2021].

Additionally, curved roof forms in the SD phase were simplified to flatter, pitched roofs in DD in order to improve constructability and water collection systems.

Non-degradable waste accumulation in developing countries like South Africa is an escalating issue, and a potential solution is research and application of recycled material use in building construction[6]. The Orlando West Fire Station will be unique in its utilization of such innovative, recycled material construction. In addition to sandbag walls, the sustainable palette consists of recycled tire retention walls, recycled tire columns, plastic bottle bricks, recycled plastic bricks, and Eco Asphalt. Recycled tires will be an iconic element of the building design. In response to existing site contours, recycled tires packed with rammed earth will be utilized as retaining walls and foundation elements – alternatives to concrete or other high-carbon materials. Four columns along the west façade of the Demonstration Bay will be formed from stacked tires, rammed earth, and steel reinforcement. This unique column structure will mimic the rammed-earth filled barrel columns used in the Shiyala Primary School located in Chongwe, Zambia[7], pictured in *Figure 1*.

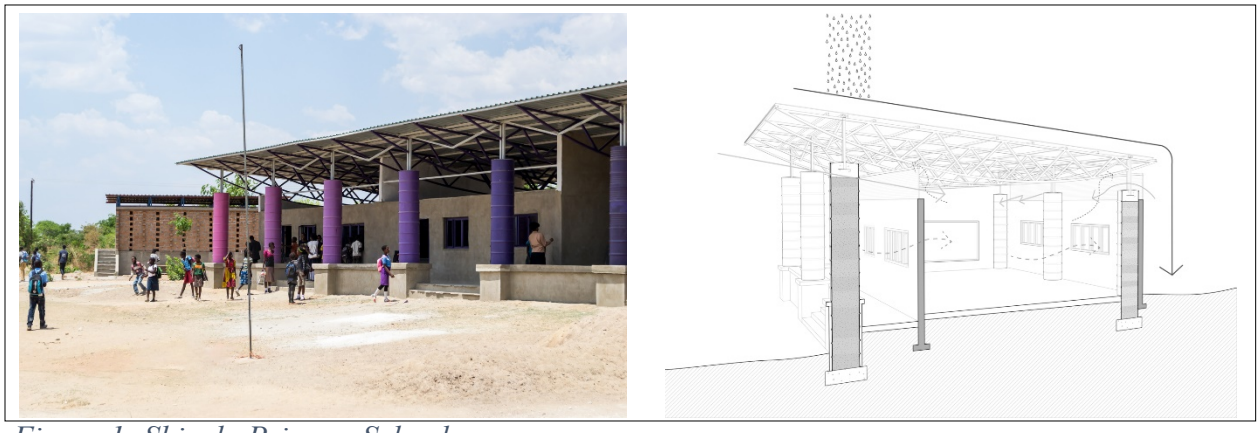


Figure 1: Shiyala Primary School

[6] Onyango, F., Salim R. Wanjala, M. Ndege, and L. Masu. "Rubber Tyre and Plastic Wastes Use in Asphalt Concrete Pavement: A Review." Accessed March 10, 2021. <https://appropriatetech.net/images/5icat/posters_construction_and_architecture.pdf.>

[7] "Mothers of Africa." BuildX Studio. Accessed May 09, 2021. https://www.buildxstudio.com/projects/mothers-of-africa/.

Existing companies, such as Los Tecnicos and Eco Design, specialize in recycled material construction and have developed construction manuals for the purpose of utilizing unskilled labor in developing countries. In Johannesburg, an initiative for recycling and waste management has begun through the public creation and donation of *Eco-bricks*, plastic bottles filled with clean, single-use plastic[8]. This innovative and increasingly popular recycling movement will be utilized in my project in the form of non-structural partitions in the community gardens and interior community space. Another form of plastic recycling through building materials is plastic composite brick tiles, which can be colored and laid in colorful and artistic patterns. These brick tiles will be sourced locally and be present through tiling of the exterior and interior spaces in the building. Lastly, vehicular parking and paved community areas would be paved with *Eco-Asphalt*, asphalt created using recycled HDPE plastic. More research continues to be done on asphalt concrete pavement, as a way to construct and repair roads utilizing plastic waste, and there is an innovative company called *Shishalanga* located in Johannesburg that specializes in this material.

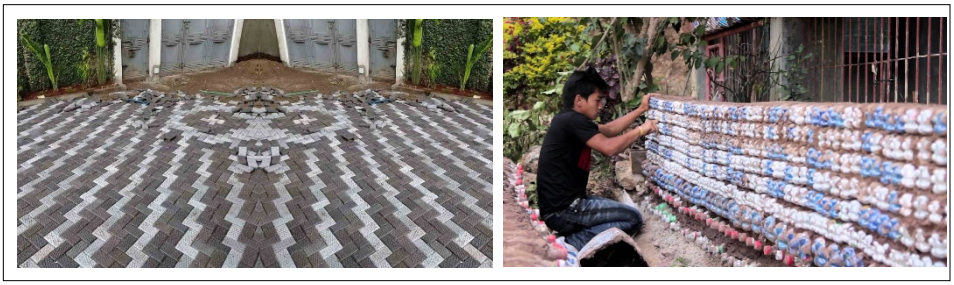


Figure 2: Plastic Composite Bricks (Gjenge), Left, and Eco-Brick Wall, Right

In addition to materiality, the building design will utilize a passive cooling strategy within the Demonstration Bay, in order to limit the amount of energy used over time. The design of the demonstration space is inspired by open-air roofing systems in Africa; however, the

[8] Hodgkinson, Savannalee. 2019. "The Future of Eco-Bricks Streamlining Recycling in the City System of Johannesburg, South Africa." University of Johannesburg.

Soweto climate calls for an enclosed building design with operable ventilation windows that can be closed during colder months. The orientation of the roofs on the north of the building are also in ideal orientation for solar energy harvesting, so rooftop solar panels will be placed on these roofs to provide a renewable energy source.

In an area with frequent rains and occasional drought, we will also utilize rainwater harvesting systems along the roof to provide a consistent water supply for the community gardens and landscaping. Two forms of rainwater recycling would occur on site. Water would slope downwards to irrigate the community gardens, while roof water would be treated and collected on-site in an underground cistern to supply water for indoor plumbing and sprinkler systems for landscaping. Using the natural slope of the site to our advantage, the gardens will employ natural irrigation systems and a bioswale at the lowest point for stormwater drainage.

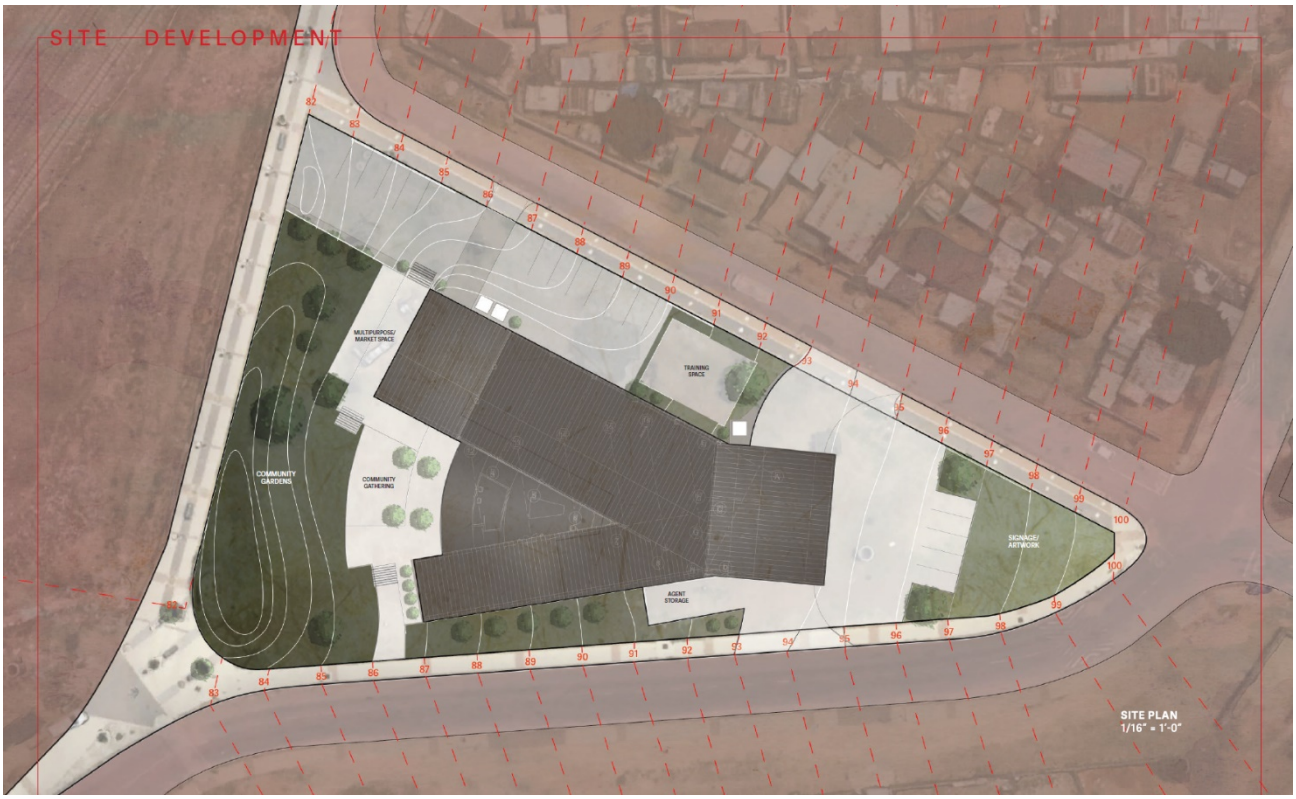
IV. Symbolism

Because the fire station site is clearly visible from both the eastern street corner and to passing trains along the west, the building requires a visual identity that reflects community values. Despite being a Western-inspired Fire Station, the building form and materiality celebrates vernacular building and construction methods by employing both natural and recycled materiality throughout. The recycled tires and plastic construction will be on display to visitors, illustrating the station's commitment to critical world issues, such as environmental sustainability and waste management. In this way, the building's material design also highlights community involvement by centering local unskilled labor and craft, artists and muralists, and locally sourced materials into the fire station's visual identity.

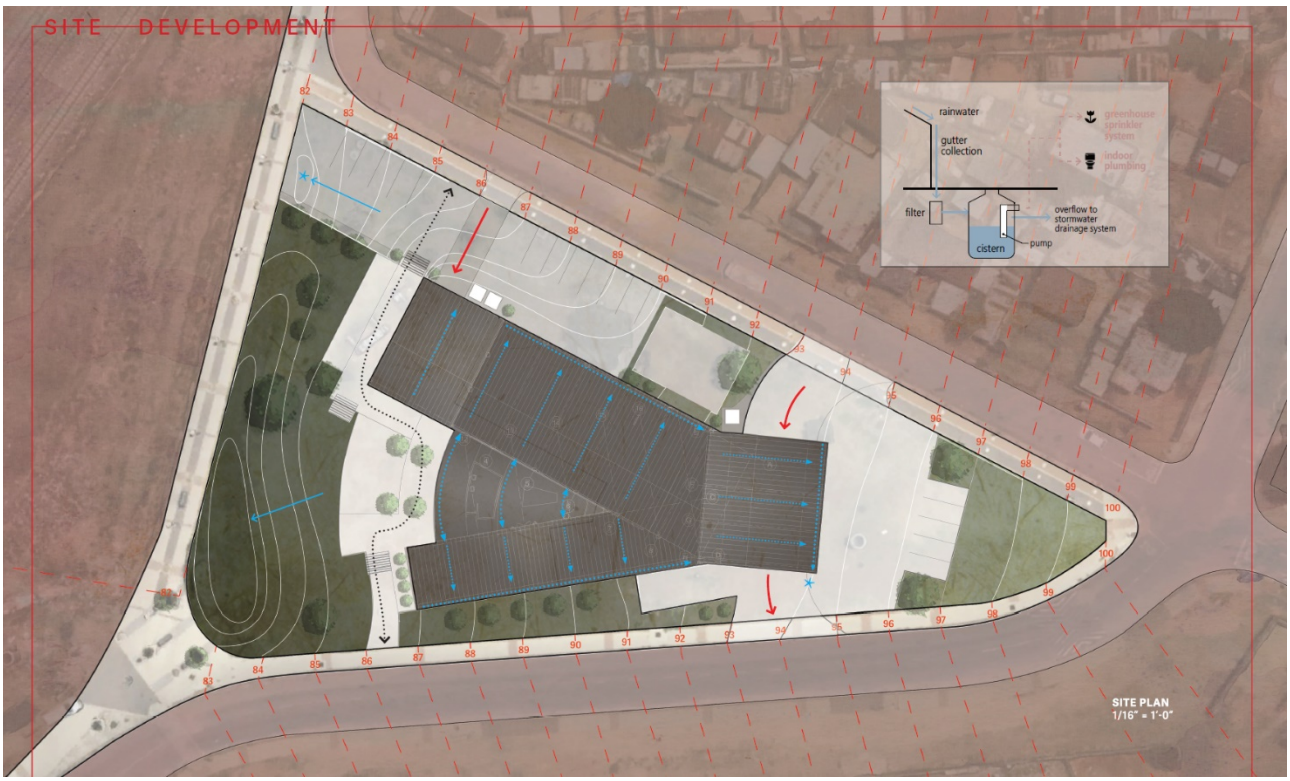
Overall, our fire station seeks to serve as a beacon to the Soweto Community, especially those in the neighboring informal settlements. Rather than simply designing the building, our design seeks to transform the site into one that belongs to the people, not simply the fire station, by investing in a public corridor that overlooks the community gardens and demonstrates government investment into the community's needs and welfare. To create a community resource center that is truly successful, it is crucial to involve the community, including local citizens, laborers, and suppliers, throughout the process – from design to construction to future maintenance. My Orlando West Fire Station is centered around heavy local involvement and the provision of free and open public resources, creating programming that will ensure the safety of citizens and ensure the communal right to a high standard of life. Through a colorful visual identity and utmost respect for the site and its citizens, my design for this station seeks to become a physical representation of hope and direction for the community.

SD Exterior Rendering

DD Exterior Rendering

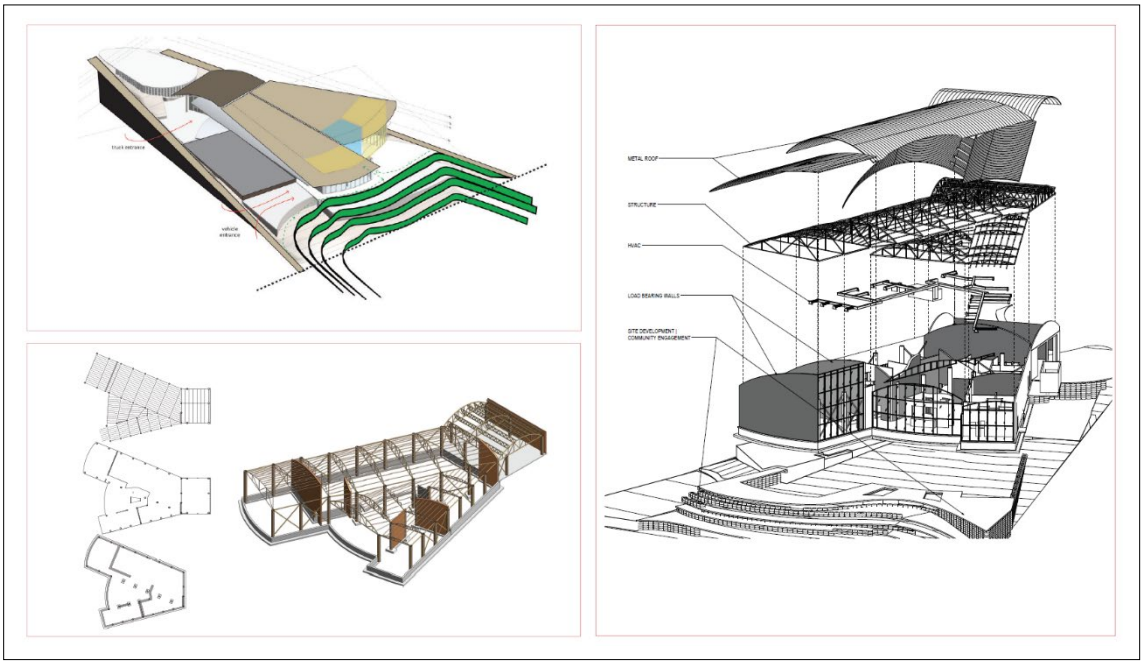


Site Plan 1

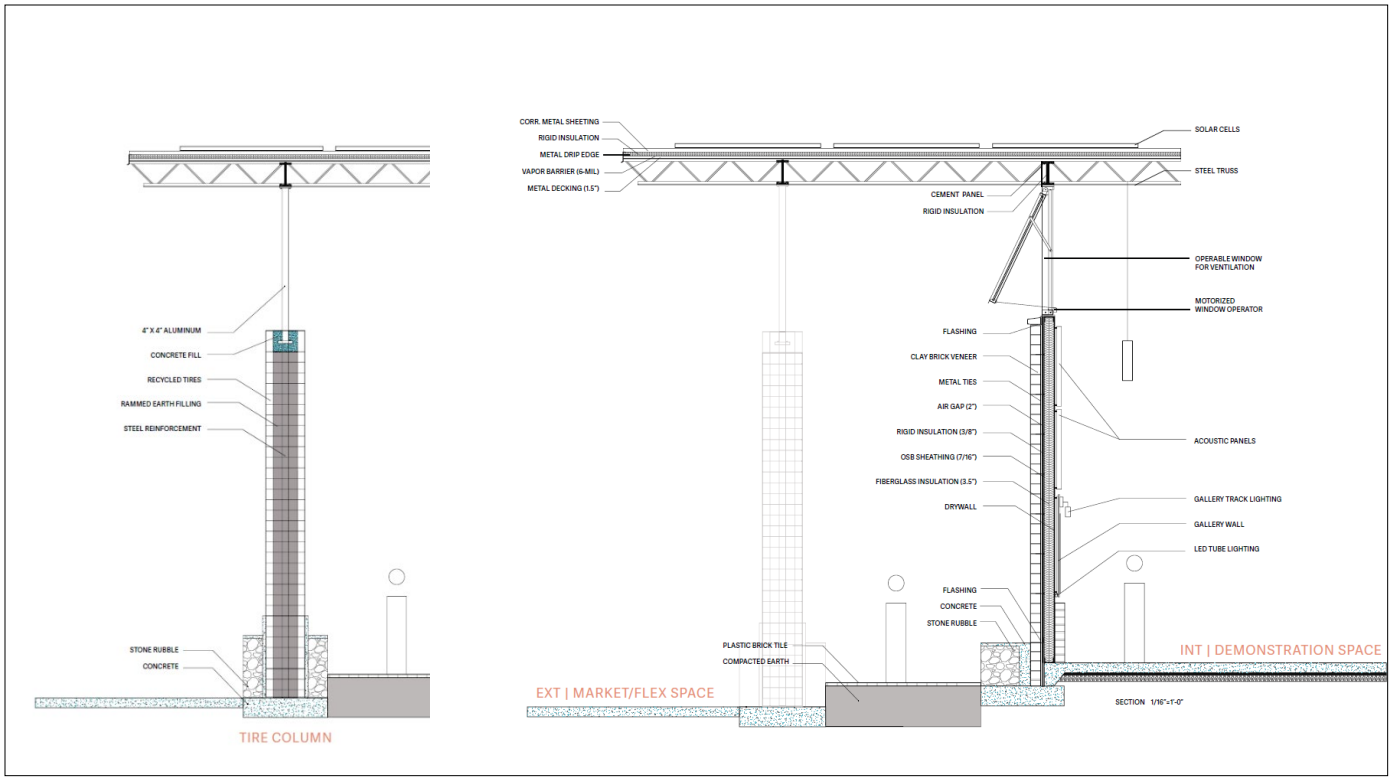


Site Plan 2

Floor Plan | Green: Fire Fighter Living, Yellow: Community, Blue: Administration, Red: Apparatus Bay/Support



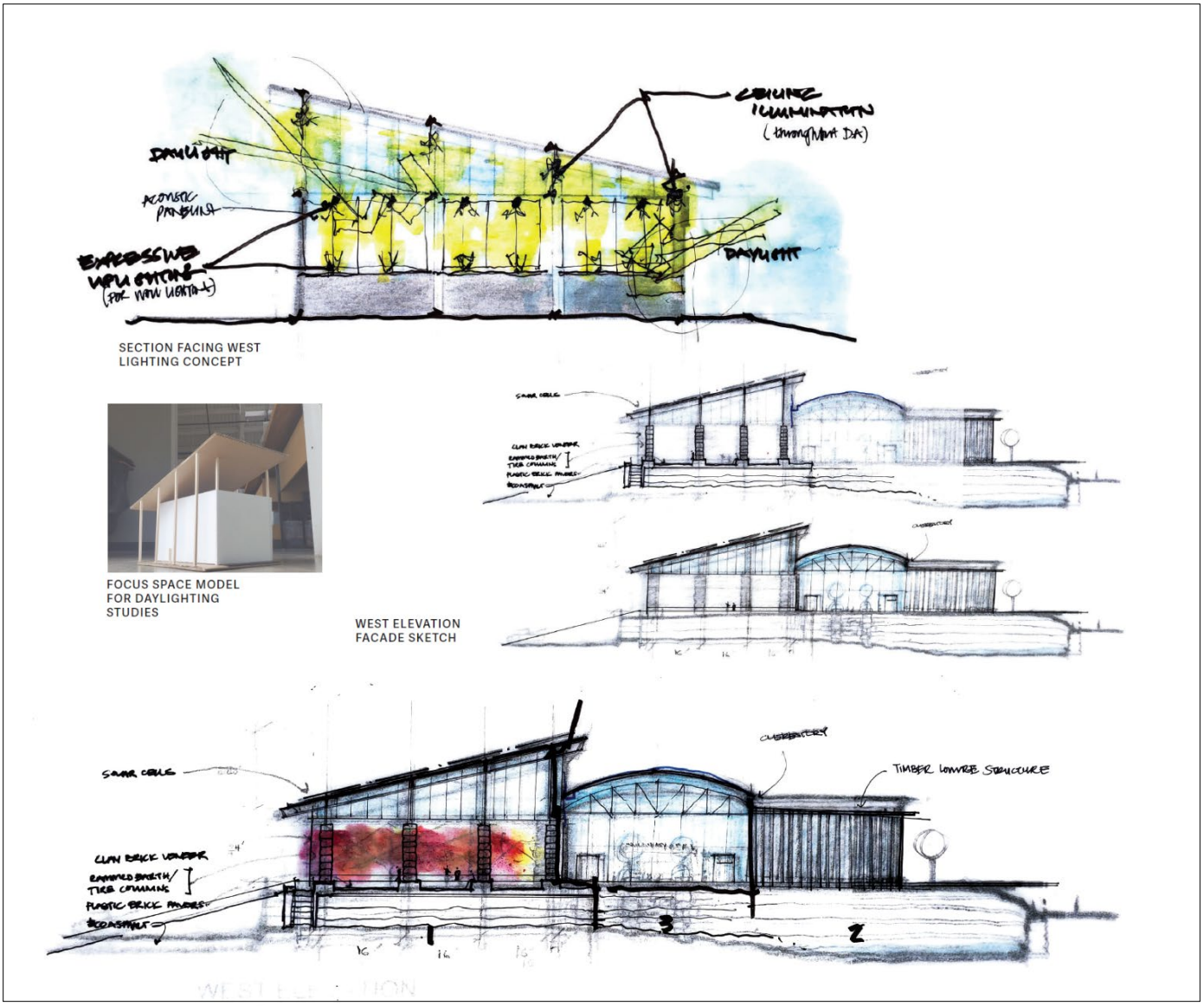
SD Design Drawings



Demonstration Space Wall Section

Demonstration Space Interior Rendering 1

Demonstration Space Exterior Model



DD Process Images